GENE AND CELL THERAPY USING CELL FUSION TECHNOLOGY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. application Ser. No. 15/873,488, filed Jan. 17, 2018 (pending), which is a continuation-in-part application of International Application No. PCT/KR2016/007610, filed on Jul. 13, 2016, which claims priority to KR 10-2015-0101577, filed Jul. 17, 2015, all of which are incorporated herein by reference in their entireties.

SEQUENCE LISTING

[0002] This application contains a Sequence Listing which has been submitted electronically in ASCII format and is hereby incorporated by reference in its entirety. Said ASCII copy, created on 24 Jun. 2021, is named OPB2018-001US-CIP_CA2_ST25 and is 4 Kilobytes in size.

BACKGROUND OF THE INVENTION

Field of the Invention

[0003] The present invention relates to gene and cell therapy using a cell fusion technology, and more particularly, to gene and cell therapeutic agents using a cell fusion technology capable of enhancing cell fusion with other cells by transducing hemagglutinin neuraminidase (HN) and fusion (F) genes into cells and overexpressing the transduced cells and restoring cell damage through cell fusion with damaged or dying cells or cells having gene abnormality.

Description of the Related Art

[0004] Generally, diseases and aging are progressed by cell damage and apoptosis. The common diseases that cause the cell damage and the apoptosis include neurodegenerative diseases, myopathy, and the like.

[0005] With the rapid increase in the elderly population, neurodegenerative diseases including damages of the brain, the spine and the peripheral nerves have been continuously increased. The causes of the neurodegenerative diseases are not clear yet. In addition, a pathological mechanism of each neurodegenerative disease is known to act a little different mechanism. However, common causes include abnormal protein aggregation, dysfunction of mitochondria, abnormality of intracellular trafficking, oxygen radical injury, excitatory toxicity, autophagy/proteosomal dysfunction, neuroinflammation, deficiency of neurotrophic factors, abnormality of RNA metabolism, and the like. Since these various pathological mechanisms act, it is difficult to treat diseases by a therapeutic agent acting on any one mechanism, and thus, almost all clinical trials have so far failed. Therefore, a therapeutic agent that acts on a wider mechanism and has a powerful effect is required. These neurodegenerative diseases include Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis (ALS, Lou Gehrig's disease) which has a rapid progressing speed of the disease and the most serious severity of the aftereffect, and the like. Particularly, the ALS-related therapeutic agents are almost not existent except for riruzole and edaravone which are approved by the FDA in US and have only an effect of the prolonged survival for about 3 months or slightly slowing deterioration of the physical function respectively, and thus, the development of a therapeutic technology is urgent. Other neurodegenerative diseases also have no therapeutic agent for a complete cure, and maybe diseases in which a new therapeutic method including a stem cell therapy is desperately required.

[0006] Currently, various therapeutic methods, such as cell transplantation and the administration of drugs to improve the symptoms, are proposed to treat the neurodegenerative diseases, and especially recently, there is attention on cell therapy. However, a conventional cell therapy technology aims to insert health cells (alternatively, stem cells) into a diseased region to replace dead cells or improve an ambient environment of the dying cells to regenerate the dying cells, but the attempt has no effect or a slight effect in many preclinical or clinical trials. Further, in the case of neuronal cells, it is very important to form a neural circuit in terms of a function unlike other organs, and thus, it is very difficult for the cell supplied from the outside to be differentiated into the neuronal cells to restore the existing neural circuit as it is. Accordingly, in addition to the conventional methods, it is urgent to develop a new therapeutic method for reducing or protecting neuronal cell damage.

[0007] Meanwhile, as diseases causing cell damage, Duchenn muscular dystrophy (DMD) and Backer muscular dystrophy (BMD) are included in muscular diseases, and these diseases are caused by abnormality of a dystrophin gene existing in an X chromosome and about ⅓ thereof is caused by natural mutation and the rest is caused by sex-linkage. Both the DMD and the BMD are caused by the abnormality of the same gene, but the DMD is called a case in which a phenotype is severe due to frame-shift mutation and the like. In the case of the DMD, since the course of the disease is poor, in 9 to 13 years of age, almost all patients are unable to walk and may be accompanied by cognitive decline as well as weakness of muscles accompanied by cardiomyopathy and respiratory distress to lead to death.

[0008] In the case of the DMD, recently, a method of attempting treatment by exon skipping has emerged. Since the exon skipping targets a splicing enhancer sequence of exon 51 of a dystrophin gene and has a principle that restores only a reading frame converting the severe mutation to a less severe gene mutant, the exon skipping may not be a complete treatment alternative and is not a treatment method for targeting all DMDs.

[0009] Therefore, the present inventors made efforts to develop a therapeutic agent for cell damage-related diseases including neurodegenerative diseases, muscular diseases, and the like, and as a result, found that cells overexpressing hemagglutinin neuraminidase (HN) and fusion (F) proteins have enhanced cell fusion with other cells by the HN and F proteins and high ability of restoring cell damage in the dying cells, and normal dystrophin was expressed by cell fusion. In addition, the present inventors found that the present invention can be usefully used to restore the cell damage in diseases causing the cell damage such as neurodegenerative diseases and muscular diseases and introduce a normal gene, and then completed the present invention.

SUMMARY OF THE INVENTION

[0010] An object of the present invention is to provide a method for reducing cell damage including: administering a vector including genes encoding hemagglutinin neuramini-